Awwa Research Foundation
Advancing the Science of Water®

REQUEST FOR PROPOSALS

ZERO LIQUID DISCHARGE AND VOLUME MINIMIZATION FOR INLAND DESALINATION (RFP 3010)

Objective

The objective of the project is to advance or develop zero liquid discharge (ZLD) technologies that may include volume minimization processes, that are less energy-intensive for desalination of impaired water sources in inland regions.

Background

It is recognized that there are few existing undeveloped or underutilized high quality sources of water supply in the United States. Many communities have access to impaired water sources (e.g., brackish groundwater, irrigation return flows, and high salinity surface water) and must make use of these sources to accommodate growth and other competing demands on water supply. Advanced water treatment processes, including desalination technologies, can effectively treat impaired waters to drinking water standards, but high energy costs and the lack of economic, efficient, and environmentally-sensitive concentrate disposal techniques impede water utilities from implementing these technologies. These challenges are of particular concern for non-coastal, or inland, communities that do not have access to large saline water bodies to receive or inject concentrate from desalination processes.

Currently, most concentrate streams from desalination facilities are disposed directly into surface waters or into sewers and wastewater treatment plants. These are the most effective and least expensive options for coastal communities. Concentrate disposal options available for inland water utilities include deep well injection, land application, evaporation ponds, and various types of mechanical evaporation technologies. However, these options are becoming less acceptable due to geological and environmental constraints and high resource costs. Zero liquid discharge, a technology that takes the extreme approach of evaporating concentrate to dry salts is a possible innovative solution to concentrate disposal.

ZLD involves the complete or near-complete solidification of residuals and close to 100% recovery of water in the concentrate stream. ZLD processes separate dissolved ions through an energy-intensive phase transformation (i.e., distillation). Often, a ZLD process will include two or more unit processes (e.g., a volume minimization followed by crystallization) to achieve

complete liquid recovery. The recovered water can be recycled back into the feed stream and/or used in other beneficial ways. The dry salts are separated and there is no discharge of liquid back into the environment. Therefore, not only does a ZLD process recover water for beneficial uses, it also eliminates the need for liquid disposal. ZLD technologies include, but are not limited to, single- and multiple-effect evaporators, vapor compression evaporator systems (brine concentrators), crystallizers and spray dryers.

Although existing ZLD technologies are well developed, they are energy-intensive and complex. Consequently, thermal ZLD processes are only considered under special circumstances where no other disposal option is available. Research is needed to advance ZLD and volume minimization science and technology to improve cost-effectiveness and energy efficiency. New ZLD and volume minimization processes could make advanced water treatment a more viable solution for inland water utilities by reducing capital and operational costs, particularly operating costs associated with power consumption.

The United States Bureau of Reclamation and Sandia National Laboratories facilitated a discussion around a guiding vision that "By 2020, desalination and water purification technologies will contribute significantly to ensuring a safe, sustainable, affordable, and adequate water supply for the United States." The results were published in *Desalination and Water Purification Technology Roadmap* (USBR, 2003) which identifies areas of research necessary to develop cost-effective technological "tools" that can be used to help solve the nation's water supply challenges. The *Roadmap* clearly identifies ZLD as an innovative technology necessary to keeping water affordable for long-term water supply needs. The *Roadmap* also establishes a 20-percent ZLD cost reduction as a Near-Term Critical Objective (by 2008) and a 50- to 80-percent ZLD cost reduction as a Mid/long-term Critical Objective (by 2010/2020). This project would advance ZLD science and technology and volume minimization processes to help meet these objectives.

Research Approach

This project will advance or develop non-thermal or less energy-intensive ZLD technologies and volume minimization processes for desalination of impaired water sources at inland sites. In order to meet the objective of the project, proposing organizations will include, at a minimum, the following tasks:

- The proposal must present a detailed approach to the experimental investigation of an innovative ZLD process or volume minimization technique(s) that may be used to reduce capital and operational costs of new or conventional ZLD processes. Preference will be given to proposals that include some element of pilot- or demonstration-scale testing. The researchers will focus on the effectiveness (i.e., product water recovery versus dry salt separation) of the ZLD technologies using impaired water qualities typical of brackish groundwater, irrigation return water, high salinity content waters, and advanced water treatment processes.

- The research team will conduct an initial evaluation of the economics for ZLD and volume minimization. The researcher will realistically compare concentrate disposal alternatives, including an assessment of energy and environmental implications.

The final report will present a literature review of ZLD, volume minimization and advanced water treatment concentrate management as related to ZLD; detail the experimental methods and findings regarding the effectiveness and improved energy efficiency of ZLD with volume minimization; and present an assessment of future research needs in this topic area.

Proposal Preparation Guidelines

Proposals submitted in response to this RFP must be prepared in accordance with the Awwa Research Foundation (AwwaRF) "Proposal Guidelines for Solicited Proposals." The most current version of these guidelines is available at http://www.awwarf.org/research/projectAdmin/proposalGuidelines.aspx. The guidelines contain provisions that the submitter should be aware of when preparing a proposal, including an enforceable page limit on the project description. **Proposals containing project descriptions that exceed this page limit will not be considered.**

The proposal must show that the research team is knowledgeable in ZLD and volume minimization processes by presenting an annotated literature review of past projects and technologies. The review will include a brief status of current research projects relating to advanced water treatment process concentrate management, ZLD, and volume minimization. The following sections provide project-specific information and instructions for responding to this RFP.

Budget and Time Schedule

The maximum funding available from AwwaRF for this project is $500,000. A minimum 25 percent of the total project cost must be contributed by the contractor. Therefore, the total project cost is $666,667 ($500,000 in AwwaRF funds). This contribution can either be direct funding or in-kind matching of such items as personnel costs, analytical and support services, facilities, consulting services, etc. The submitting organization may elect to contribute more than 25 percent to the project but AwwaRF's maximum contribution remains fixed at $500,000. Proposals that request less than $500,000 from AwwaRF need only contribute 25 percent of the total project cost.

The project period should be realistic, anticipate possible starting delays, and provide ample time for the writing of final reports and for Project Advisory Committee (PAC) review of project results. Funding for this project expires on June 30, 2007. Progress reports will be required on a quarterly basis in a format acceptable to the Foundation and the California Energy Commission. The final report must be submitted in a format that is camera-ready to publish and should include a separate chapter on recommendations to utilities. Independent of this contract, AwwaRF will fund the PAC described below.

Project Advisory Committee (PAC)

PACs are organized by AwwaRF for each funded project to provide guidance, review all reports and significant materials, and generally monitor project performance on behalf of AwwaRF and the water supply community.

California Energy Commission

This project is funded in part by the California Energy Commission. All proposals must address energy efficiency, cost or reliability for the water or wastewater treatment industries in accordance with the research goals and objectives of the Public Interest Energy Research (PIER) program, http://www.energy.ca.gov/pier/index.html. The Commission will provide input to this project through review of quarterly reports submitted by the contractor to the Foundation.

Quality Assurance

Each proposal must include a description of the procedures that will be used to ensure the quality of the data for the project. If the project involves laboratory analyses, this description should indicate whether the laboratory performing the analyses is accredited or state certified for the particular analysis. If the laboratory is not certified, and/or nonstandard methods are used, detailed quality assurance/quality control procedures must be submitted with the proposal.

Equal Opportunity and Minority Contractors

AwwaRF has a policy of non-discrimination and abides by all laws, rules, and executive orders governing equal employment opportunity. As employers, AwwaRF contractors may not discriminate on the basis of age, sex, race, religion, color, national origin, handicap or veteran status. AwwaRF expects its contractors to accept the goal of having a workforce that generally reflects the minority composition of the community in which it is located. It is the policy of AwwaRF to encourage proposals from qualified minority owned or directed institutions.

Utility Participation

AwwaRF is especially interested in receiving proposals which include both participation and contribution of resources from water utilities. Information on utilities that have indicated an interest in participating in this research project is attached. However these utilities are under no obligation to participate. Their level of participation is solely their decision. If asked to participate by several proposers, the utility may choose to work with any, all, or none of them. Check the AwwaRF website for updates to the attached list of utilities.

WaterStats

A WaterStats database containing water utility information that may be helpful in preparing proposals is available from AWWA; see www.awwa.org/Communications/h20stats/index.cfm for further information.

Past Performance

AwwaRF's policy on timeliness can be found on the Foundation's website at http://www.awwarf.org/research/projectAdmin/docs/TimelinessPolicy.pdf. Timeliness of researcher performance on past AwwaRF projects will be a factor in proposal selection. Further, researchers who are late in any ongoing AwwaRF sponsored studies without an approved no-cost extension are not eligible to be a named participant in any proposal for the 2003 funding cycle. If you have any questions about your eligibility for 2003 projects, please contact your current AwwaRF project manager directly.

Application Procedure and Deadline

Questions to clarify the intent of this Request for Proposals may be addressed to the project manager Jennifer Warner, at 303-734-3422 or by e-mail at jwarner@awwarf.org. **Proposals must be postmarked on or before February 17, 2004.** Eight copies of the proposal should be sent to:

Proposal 3010
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